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Aluminium

Aluminium is the most abundant of all metals and the third most abundant element in the Earth's crust, after oxygen and silicon. It makes up about 8% by weight of the Earth's solid surface. Aluminium is too reactive chemically to occur in nature as the free metal. Instead, it is found combined in over 270 different minerals [1]. The chief source of aluminum is bauxite ore. Aluminum is remarkable for its ability to resist corrosion (due to the phenomenon of passivation) and its light weight. Structural components made from aluminium and its alloys are vital to the aerospace industry and very important in other areas of transportation and building.

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Properties

Aluminium is a soft, lightweight metal with appearance ranging from silvery to dull gray, depending on the surface roughness. Aluminium is nontoxic, nonmagnetic, and nonsparking. The yield strength of pure aluminium is 7–11 MPa, while aluminium alloys have yield strengths ranging from 200 MPa to 600 MPa.^[2] Aluminium has about one-third the density and stiffness of steel. It is ductile, and easily machined, cast, and extruded.

Corrosion resistance is excellent due to a thin surface layer of aluminium oxide that forms when the metal is exposed to air, effectively preventing further oxidation. The strongest aluminium alloys are less corrosion resistant due to galvanic reactions with alloyed copper.^[2]

Aluminium atoms are arranged in an FCC structure. Aluminium has a high stacking-fault energy of approximately 200 mJ/m².^[3]

Aluminium is one of the few metals which retain full silvery reflectance in finely powdered form, making it an important component of silver paints. Aluminium mirror finish has the highest reflectance of any metal in the 200–400 nm (UV) and the 3000–10000 nm (far IR) regions, while in the 400–700 nm visible range it is slightly outdone by silver and in the 700–3000 (near IR) by silver, gold, and copper.

Aluminium is a good thermal and electrical conductor, by weight better than copper. Aluminium is capable of being a superconductor, with a superconducting critical temperature of 1.2 Kelvin.

Applications

General use

Whether measured in terms of quantity or value, the global use of aluminium exceeds that of any other metal except iron, and it is important in virtually all segments of the world economy.

Relatively pure aluminium is encountered only when corrosion resistance and/or workability is more

Ionization energies (more)	1st: 577.5 kJ·mol ^{−1}				
	2nd: 1816.7 kJ·mol ^{−1}				
	3rd: 2744.8 kJ·mol ^{−1}				
Atomic radius	125 pm				
Atomic radius (calc.)	118 pm				
Covalent radius	118 pm				
Miscellaneous					
Magnetic ordering	paramagnetic				
Electrical resistivity	(20 °C) 26.50 nΩ·m				
Thermal conductivity	(300 K) 237 W·m ^{−1} ·K ^{−1}				
Thermal expansion	(25 °C) 23.1 μm·m ^{−1} ·K ^{−1}				
Speed of sound (thin rod)	(r.t.) (rolled) 5000 m·s ^{−1}				
Young's modulus	70 GPa				
Shear modulus	26 GPa				
Bulk modulus	76 GPa				
Poisson ratio	0.35				
Mohs hardness	2.75				
Vickers hardness	167 MPa				
Brinell hardness	245 MPa				
CAS registry number	7429-90-5				
Selected isotopes					
Main article: Isotopes of aluminium					
iso	NA	half-life	DM	DE (MeV)	DP
²⁶ Al	syn	7.17×10 ⁵ y	α ⁺	1.17	²⁶ Mg
			β [−]	-	²⁶ Mg
			β [−]	1.8086	-
²⁷ Al	100%	Al is stable with 14 neutrons			
References					